Computers & Education 135 (2019) 123–137

Contents lists available at ScienceDirect

Computers & Education

journal homepage: www.elsevier.com/locate/compedu

Online gaming motive profiles in late adolescence and the related longitudinal development of stress, depression, and problematic internet use

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ARTICLE INFO

Keywords:
Late adolescent
College students
Internet gaming disorder
Gaming motives
Advancement
Socializing
Escapism
Depression
Stress
Problematic internet use

ABSTRACT

Many studies have shown that some game motives help to identify the risk for the development of problematic Internet use, especially advancement, escapism and socializing. Previous researchers have investigated multiple risky motives in each study but treated them as individual variables with less concern about their interplay. However, in many studies, the results showed that all gaming motives were correlated, implying the possibility that gamers might endorse multiple motives simultaneously. This study thus adopted a person-centered approach that was capable of distinguishing people with apparent combinations of gaming motives.

The first aim of this study was to examine the co-occurrence of three different gaming motives, using latent profile analysis. The second aim of this study was to examine whether there were differences among gamer profiles in their characteristics, problematic Internet use, depression, and other well-being indicators across five time points. Panel data were collected from the same college student sample every six months for 2 years, from 2012 to 2014. At time point 1, a total of 387 freshmen (female = 109; male = 278) were recruited in Taiwan. Four reliable clusters of gamers were identified: high-engagement, medium-engagement, low-engagement, and healthy-engagement. The validated analysis results showed that the high-engagement gamers were risky and had higher depression and problematic Internet use scores than the other gamer clusters from time 1 to time 5. Academic performances had no significant effect on the 4 gamer clusters from time 1 to time 5. When the high-engagement cluster was compared to the healthy-engagement cluster, the major difference was seen in the level of escapism motives and the consequent risk of developing negative psychological symptoms. However, when the healthy-engagement cluster was compared to the low-engagement cluster, there were no significant differences in their level of escapism motive or psychological outcomes in depression and problematic Internet use (PIU) scores. Taken together, these findings imply that the endorsement of the escapism motive might be a risky inner factor for depression, PIU, and other well-being indicators in college gamers.

Based on our findings, the person-centered study may provide further insights to help gamers with functional impairment. In addition, intervention programs can be designed to bring awareness to gamers' own escapism motives and to persuade them to face the pressures and problems in real life.

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https://doi.org/10.1016/j.compedu.2019.02.003
Received 12 October 2018; Received in revised form 29 January 2019; Accepted 7 February 2019
Available online 18 February 2019
0360-1315/

1. Introduction

Online games are user-centered designs. Designers focus on motives and feelings of gamers to make them feel enjoyment, attraction and engagement towards gaming (Ng, Khong, & Thwaites, 2012). The designer aims to optimize the gamer's feelings and motivations and to allow gamers to be continuously immersed in the game (Zichermann & Cunningham, 2011). They design the basic elements, such as randomness, competitiveness, rewards, rules, and mimics (Huizinga, 1955) into an online game and create a virtual world to simulate the presence of "being" (the feeling of presence). Some studies have shown positive outcomes of game playing. For example, gamers were able to learn and experience teamwork by exploring new roles and skills in-game (Barnett & Coulson, 2010; Chang & Lin, 2014; Gee, 2003; Yee, 2006a). Moreover, online games allow players to develop social skills, reduce negative emotions, and feel more relaxed and content (Feng, Spence, & Pratt, 2007; Hausknecht, Schell, Zhang, & Kaufman, 2015). In contrast, many studies have shown that some game motives help to identify the risk for the development of Internet Gaming Disorder (Ballabio et al., 2017; Beard & Wickham, 2016; Chang, Hsieh, & Lin, 2018; Laconi, Pirès, & Chabrol, 2017). In fact, gamers are motivated by multiple game motives (Demetrovics et al., 2011; Hilgard, Engelhardt, & Bartholow, 2013; Lafrenière, Verner-Filion, & Vallerand, 2012; Yee, 2006a). We conducted interviews focused on high-risk Problematic Internet Use (PIU) in college students (n = 41) in Taiwan. The results showed that more than half of the high-risk students' (n = 21) major Internet activities were online games (Chang, Yeh, Chen, & Lin, 2013).

Because motivation is the driving force that encourages people to work, many researchers have investigated possible causes and outcomes of gaming motives. Most of them focused mainly on variable-centered analyses, assuming that the population is homogeneous (Laursen & Hoff, 2006). Furthermore, they described the relationship between variables using techniques such as correlation, general linear modeling, structure equation modeling, etc. (King, Herd, & Delfabbro, 2018; Laconi et al., 2017; Männikkö, Billieux, Nordström, Koivisto, & Kääriäinen, 2017; Yee, 2006b). Very few studies in the past have adopted the person-centered approach (Billieux et al., 2015), which distinguishes people who have different motive profiles. In real life, finding gamers' motive combination is a stepping stone towards finding interventions for problematic gamers; therefore, adopting cluster analysis in a study is reasonable. This implies that gamers' motive compositions may need to be treated as categorical sets to capture complex and perhaps nonlinear relationships (Laursen & Hoff, 2006; Pasta, 2009).

It is expected that late adolescence students in their transition from high school to college are under pressure. The study in the past (Gall, Evans, & Bellerose, 2000) has shown that college students have more psychological problems than before. Pittman and Richmond (2007, 2008) suggested that college students required academic adjustments and psychological adjustments, especially those in their freshman year. When they are well adapted, they will have higher academic grades and less behavioral problems.

The current study explores the latent profiles of gamers and uses a person-centered approach to examine the co-occurrence of multiple gaming motives. In addition, we follow up each cluster across five time points to observe the differences in psychological adjustments (peer-relation stress, depression, and problematic Internet use) and academic adjustments (academic performance and academic stress) at five time points.

1.1. Gaming motives: advancement, socializing, and escapism

Gamers might start gaming due to a single motive. To get adept at the game, s/he often needs to develop multiple motivations. Therefore, to capture the inner psychological drives of gamers, the highest quality scales of gaming motives are developed to be multiple dimensions (Demetrovics et al., 2011; Hilgard et al., 2013; Lafrenière et al., 2012; Yee, 2006a). For example, Yee (2006a) collected self-report data from approximately 30,000 MMORPG gamers through a gaming motive scale developed in 2006. The scale contained 3 motive components with 10 subfactors: achievement components (including advancement, mechanics, and competition), social components (including socializing, relationships, and teamwork), and immersion components (including discovery, role-playing, customization and escapism). Next, Dementrovics et al. (2011) developed motives for online gaming questionnaire (MOGQ). The questionnaire had 27 items and identified seven motivational factors (including social, escape, competition, coping, skill development, fantasy, and recreation). In 2012, Lafrenière et al. (2012) used self-determination theory (SDT) to identify six factors of gaming motives (including intrinsic motivation, integrated regulation, identified regulation, introjected regulation, external regulation, and amotivation). In addition, Hilgard et al. (2013) identified 9 gaming motives: story, violent catharsis, violent reward, social interaction, escapism, loss-sensitivity, customization, grinding, and autonomy. Although these measurement tools had different classifications of gaming motives, they all acknowledge the multifaceted nature of gamers' motives.

In past studies, three motives were often found to be related to problematic online games or Internet gaming disorder, i.e., advancement (Beard & Wickham, 2016; Chang et al., 2018; Hilgard et al., 2013), escapism (Chang et al., 2018; Hilgard et al., 2013; Laconi et al., 2017), and socializing (Beard & Wickham, 2016; Hilgard et al., 2013; Laconi et al., 2017). In addition, several gaming studies found that "escapism" is related to Internet gaming disorder, albeit with other different motives (Kardefelt-Winther, 2014; Kim et al., 2017; Király et al., 2015).

Most studies included these three gaming motives and investigated the relations between motives and Internet addiction/Internet gaming disorder (IGD), although the results had not necessarily showed significant relations between them. For example, in 2017, Männikkö et al. (2017) investigated a sample of 271 young adults (age 13–24) to find that advancement, escapism and social motives were associated with problematic gaming behavior (PGB). In addition, Beard and Wickham (2016) recruited 600 massively multiplayer online role-playing game (MMORPG) players and showed that the advancement motive predicted problematic gaming behavior. A study of 327 gamers in Italy (Ballabio et al., 2017) showed that escapism could predict IGD. The results from studies performed by Hilgard et al. (2013) showed that the use of games to escape daily life and the use of games as a social outlet were

factors that were significantly related to pathological game use. Laconi et al. (2017) recruited 418 online gamers (aged from 18 to 30 years) and showed that the problematic gamers had higher mean scores of escape and social motives than the nonproblematic gamers.

Yee (2006a) identified that in-game advancement involves seeking and accumulating items (for example, energy or monetary tokens) and equipment to make the avatars stronger or more well known in the gaming community. Escapism is a desire to escape the harsh realities and worries of life or to relax after a hard day at work, impelling people to continuously immerse themselves in games (Henning & Vorderer, 2001; Yee, 2006a). Socializing in-game involves building meaningful relationships and helping or chatting with others in the gaming community (Yee, 2006a).

As described above, past research on gamer motives has aimed to reveal as many as possible different goals that gamers may hold. Their research focus has been on either "how many distinct goals are the gamers might develop?" (Yee, 2006a; Király et al., 2015) or "what is the outcome of each gaming motive, holding other motives constant?" (Király et al., 2015; Chang et al., 2018). These previous studies were based on "variable-centered statistical analysis" to explore the relation between motives and PIU or IGD. However, the results of Chang et al. (2018) and Király et al. (2015) demonstrated that all gaming motives are correlated, implying the possibility that gamers might endorse multiple motives simultaneously. Based on our research experience, we believe that different gamers may have various mixtures of motives. Therefore, it is reasonable to examine multiple simultaneous motives within an individual. "Person-centered research" is critical in searching for meaningful subtypes for clinical interventions, but it has been relatively rare compared with variable-centered studies in the field of gaming motives. An innovative study that adopted a person-centered approach was conducted by Billieux et al. (2015). They collected cross-sectional data from 1057 Belgium adult (age range 18–66) "World of Warcraft (WoW)" gamers recruited through advertisements. The gamers were asked to fill out an online survey anonymously and voluntarily. Five gamer clusters were identified through consecutive nonhierarchical K-means cluster analyses. Of the five, three were problematic and two were nonproblematic clusters. The three problematic groups were "Unregulated Achievers", "Unregulated Escapers", and "Hard-Core Gamers". Among them, the "Unregulated Escapers" and "Hard-Core Gamers" both had high escape scores. The results showed that the gamer clusters with high escapism motives are related to high gaming addiction symptoms.

However, this study did not demonstrate the long-term outcomes of various gamer groups. In the past, most research pertaining to gaming motives and problematic Internet use were mostly cross-sectional studies (Király et al., 2015; Laconi et al., 2017; Männikkö et al., 2017); longitudinal studies were seldom seen from the literature. To fill in this gap, the present study aims to conduct longitudinal analysis which benefits us in observing the progression issues of the gaming motives and problematic Internet use. Since it takes time for PIU to develop and the gamers' motives might expand over time, it is important to examine the long-term effects of possible gamer subtypes based on their multiple motives.

1.2. Gamer maladaptive consequences: PIU, stress, depression, and academic performance

Regarding gamers' maladaptive consequences, this study adopts the adjustment view suggested by Pittman and Richmond (2007, 2008). They suggested that the college student's adjustment status (including psychological adjustments and academic adjustments) are greatly important. Psychological adjustment issues concerned are peer-relation stress, depression, and problematic Internet use; while, academic adjustment issues include academic performance and academic stress. The college gamers are students and late adolescence at the same time and each role has its own function to perform. When college students experience long-term academic maladjustment or psychological maladjustment, he/she will be likely to have increased stress or emotional distress, especially during their freshman year (Gall et al., 2000; Wintre & Yaffe, 2000). The topic of whether gamers will develop problematic Internet use is followed closely by not only the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) but also the International Classification of Diseases 11th Revision (ICD-11).

1.2.1. IGD and PIU

In 2013, Internet Gaming Disorder was listed in the appendix of DSM-5, meaning that psychiatrists consider the inclusion of maladaptive Internet gaming as a potential candidate for clinical diagnosis. The diagnosis describes IGD as a type of behavioral addiction that refers to "Persistent and recurrent use of the Internet to engage in games, often with other players, leading to clinically significant impairment or distress (American Psychiatric Association, 2013)." In addition, WHO added gaming disorder (GD) to the addictive disorders section in the ICD-11 (World Health Organization, 2018), demonstrating a global trend in acknowledging IGD as a disorder. The terminology for excessive online gaming has not been standardized before IGD or GD was listed as a Condition for Further Study in the DSM-5 or ICD-11; nomenclature has varied from problematic Internet use (PIU), Internet use disorder, pathological Internet use, technology use disorder, pathological technology use, compulsive Internet use, problematic online gaming, pathological gaming, gaming addiction, excessive gaming, gaming use disorder, or video game addiction (Young, 1998; Grüsser, Thalemann, & Griffiths, 2007; Ko, Yen, Yen, Lin, & Yang, 2007; Griffiths & Meredith, 2009; van Rooij, Schoenmakers, van de Eijnden, & van de Mheen, 2010; Sim, Gentile, Bricolo, Serpelloni, & Gulamoydeen, 2012; Pápay et al., 2013; Lemmens, Valkenburg, & Gentile, 2015; Männikkö, Billieux, & Kääriäinen, 2015; Rehbein et al., 2015). PIU is one of the commonly used terms.

Problematic gaming use has been shown to lead to PIU, depression, higher stress levels, anxiety, loss of appetite, sleep disturbances, and reduced physical activity in college students (Canale et al., 2018; Hellström, Nilsson, Leppert, & Åslund, 2015; Kim et al., 2017; Kim, Namkoong, Ku, & Kim, 2008; Li, Zou, Wang, & Yang, 2016; Stetina, Kothgassner, Lehenbauer, & Kryspin-Exner, 2011). In addition, college students with high involvement in gaming have been found to have reduced academic performance due to frequent absences from classes to play games (Burgess, Stermer, & Burgess, 2012; Hellström et al., 2015; Kaczmarek & Drążkowski, 2014).

1.2.2. Depression

Hankin et al. (1998) described the development of clinical depression in preadolescence over the course of 10 years. In New Zealand, 1037 children were followed and assessed from 11 to 12 years old to 21 years old. The results showed that a critical trigger for depression occurred during freshman year in college, when college freshmen left home and entered a new environment. The incidence of depression for sophomore year to senior year college students gradually decreased. Other studies (e.g., Cole et al., 2002; Hankin et al., 1998) have shown that the increase in the incidence of depression has two peak periods during adolescence. The first peak period occurs during Grades 6 and 7 (Cole et al., 2002), and the other occurs during the college freshman year, where students' negative emotions increase (Hankin et al., 1998; Pritchard, Wilson, & Yamnitz, 2007). The students' maladjustment requires attention when they first go to college.

In another study, Kandell (1998) showed that people with high problematic Internet use (PIU) scores simultaneously experience depression. Many studies also found a significant positive correlation between PIU and depression (Chak & Leung, 2004; Lam, Peng, Mai, & Jing, 2009; Whang, Lee, & Chang, 2003; Yen et al., 2008). Adopting the experimental method to examine the causal relationship between PIU and depression is liable to bring up controversial issues. Yeh (2013) created a panel study to follow college students at three different time points. Her study analyzed the data using a longitudinal mediation model to show that depression can predict PIU of the next wave, but PIU cannot predict later depression over the course of freshman to junior years. Chen and Lin (2016) used a latent growth curve model to track college students' depression and PIU scores through five time points. Their results showed that students with higher initial levels of depression had higher PIU scores, and the students with a faster decline in depression levels had lower PIU scores. This implies that students who successfully find ways to adapt to university life would reduce depression and PIU symptoms. Another possible explanation is that excessive use of the Internet might be a way for college students to cope with their depressive moods. When they gradually adapt to the environment, their depressive moods and PIU behaviors decrease. Using the Internet is a way for people to address the difficulties of life and ease depressive mood and emotional disturbances. The anonymity of human interactions on the Internet allows depressed people to share their problems via the Internet and reduce depressive mood. The depressive moods of individuals might lead to their overuse of the Internet (Caplan & Turner, 2007).

1.2.3. Stress

The results of Misra, McKean, West, and Russo's (2000) study indicated that within the general college population, freshmen and sophomores had higher mean levels of stress compared to when they were in middle school and high school. Many related findings have been provided in past studies. For example, Zhao et al. (2017) and Yan, Li, and Sui (2014) found that there was a significant relationship between stressful life events and PIU in college students. However, these studies did not specify stressful life events into various categories.

The main sources of stress for college students were academic and social. Li, Wang, and Wang (2009) provide related evidence about PIU and stress. They recruited Chinese college students ($n = 624$) and categorized them as the PIU group (with a score higher than 73, the previously established cutoff point of a self-report PIU scale) versus the non-PIU group. The results showed that the frequency of stressful events within the PIU group was significantly higher than in the non-PIU group. This study also compared the stressful life events over the past six months between the PIU and non-PIU groups, showing that both academic stress and social stress levels were significantly higher for PIU groups. Accordingly, an investigation of high-risk gamers (Chi & Lin, 2005) also found that academic pressure and interpersonal conflicts in the real world were major sources of stress for high-risk gamers.

The above findings suggested that college students' social stress was related to PIU. College students are generally concerned about their social life such that poor interactions between students and peers will create social stress. Good social interactions are an important social support that provides the function of relieving stress. Park (2014) commented that the Internet is a place for people to relieve stress and receive social support. According to investigative reports (ESA, 2014; TWNIC, 2015), almost 60% of players play with other people. Most online games require players to socialize with each other in-game. Although social interaction is a source of stress, it is also an important element to facilitate adolescent development. Taylor, Jenson, de Castell, and Dilouya (2014) found that most gamers are exceptionally socially active, contrary to the stereotype that gamers are socially withdrawn. Online games allow players to develop social skills, reduce negative emotions, and feel relaxed and content (Feng, Spence, & Pratt, J., 2007; Hausknecht et al., 2015). The relationship between socializing and PIU became more complicated when college students used socializing as a form of coping strategy. Gamers who become involved with online gaming to cope with daily troubles or social rejection have been found to have a high risk of PIU (Kardefelt-Winther, 2014). College gamers with high PIU tend to use avoidant strategies to escape everyday stressors and to avoid daily responsibilities (Chang et al., 2018; Kardefelt-Winther, 2014). Therefore, we infer that dealing with stress through an escapism coping strategy might lead to Internet gaming disorder. This evidence showed that some gamers escaped into the virtual world when they encountered stressful events in real life. These gamers could temporarily forget their troubles through socializing and playing in the game. However, the problems could be temporarily forgotten. Within this vicious cycle, even if the gamers had a high frequency of socializing, their stress, depression level, and PIU state would continue to worsen. The current study analyzes gamers with different motive combinations to explore the relationship of social motives, social stress, and PIU. In doing so, we could further clarify the mixed relationship between socializing and PIU.

1.2.4. Academic performance

As mentioned above, game motivation is the driving force of gaming, and academic performance is a remote outcome of game motivation. Between these two, most researchers regard gaming time as playing a role. Very little evidence has been collected to describe the remote relation of gaming motivation and academic performance. Therefore, in the following, we provide some insightful correlational results of gaming time and academic performance.

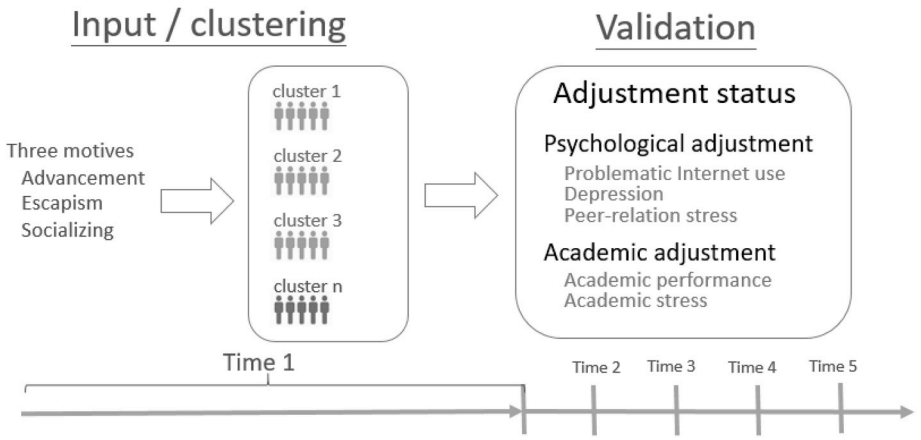


Fig. 1. Research framework and variables.

In the last decade, many studies have explored the relationship between game involvement and academic performance. The participants of the studies were student-gamers and could be categorized into two major groups: college gamers and gamers who had not reached college (i.e., high school, middle school, elementary school students). In studies that include college students as samples, most results showed a negative correlation between gaming time and academic achievement (Ventura, Shute, & Kim, 2012; Burgess et al., 2012; Jiang, 2014). In Burgess, Stermer, and Burgess' (2012) study, college students who played video games in their leisure time had been found to have poor academic performance due to frequent absences from classes. Only Tobias (2017) study, which included 93 college students (71 females), showed that a non-relationship was found between time spent on video games and academic performance.

Studies that focused on children and adolescents who are in high school and below showed a null relationship (Ferguson, 2011; Griffiths & Hunt, 1998; van Schie & Wiegman, 1997) or a low positive relationship (Skoric, Teo, & Neo, 2009) between gaming time and academic performance. Only Jackson, von Eye, Fitzgerald, Witt, and Zhao's (2011) study showed a significant but low negative relationship between gaming time and academic performance.

The results regarding the relationship between gaming time and academic performance differ between studies on college students and children of younger ages. In the studies with college students, most results found a negative correlation between gaming time and academic achievement, while in those who are in high school or younger, the correlation is not significant.

To study the relationship between gaming time and academic performance in college students, the participants must be college students who play online games. At present, related studies are still rare, all of which are cross-sectional investigations. The current study examined the issue of academic performance and academic stress for college students with various gaming motives.

2. The current study

The first aim of the current study (see Fig. 1.) was to examine the co-occurrence of three different gaming motives: advancement, escapism, and socializing in late adolescence (college freshmen) using a person-centered approach with latent profile analysis (LPA). We specifically focused on late adolescence because this developmental period is generally perceived as when adolescents start to leave home (live in the dormitory) and are able to manage their time more independently in comparison to high school days. To examine the distinction of each identified cluster, we collected repeated measurements of outcome variables from college gamers. Therefore, the second aim of this study was to examine whether there were differences in gamer adjustment status characteristics, included academic adjustments (academic performance and academic stress) and psychological adjustments (problematic Internet use, depression, and peer-relation stress) among each cluster across five time points. We adopted the LPA technique with the three motives scores (advancement, escapism, socializing) of gamers (n = 387) in time 1 as the input variables. Next, we examined groups' changes over the course of five time points.

The research questions are summarized as follows:

#1: How many different patterns of subpopulations of college freshmen gamers can be found based on their gaming motives of advancement, socializing, and escapism?
#2: How different are the levels of advancement, socializing, and escapism for each subpopulation?
#3: How do these subpopulations differ in terms of gamer adjustment status included academic adjustments (academic performance and academic stress) and psychological adjustments (problematic Internet use, depression, and peer-relation stress) across five time points?

3. Method

3.1. Participants

Participants were drawn from a longitudinal dataset to investigate the well-being of college students in Taiwan, and the study was financially supported by the Ministry of Science and Technology of Taiwan. Panel data were collected from the same sample every six months (five time periods) for 2 school years, from 2012 to 2014. At time point 1, a total of 387 freshmen (female n = 109, 28.2%; male n = 278, 71.8%) were recruited. The average age of the participants was 19.43 years old (Standard Deviation, SD = 0.67) at time 1. The data were consecutively collected at five time points (Time 1, n = 387; Time 2, n = 333; Time 3, n = 315; Time 4, n = 308; Time 5, n = 292). The missing data rate (from Time 1 to Time 5) was 24.5%.

We adopted the latent profile analysis (LPA) technique with the three motive scores (escapism, advancement, socializing) of gamers (n = 387) at time 1 as the input variables. Next, based on Time 1 LPA results, we examined the groups' differences at five time points.

3.2. Measures

3.2.1. Online gaming motive scales of advancement, escapism and socializing

The three online gaming motives were collected from three scales. The advancement motives scale and escapism motives scale were adopted from the Chinese version of the Online Gaming Motivation Scale (OGM-C)-modified from Yee (2006b) with permission. The original OGM scale contains 10 factors using a five-point scale. Among 10 factors, only 2 motive factors were selected for statistical analysis in this study. The first was advancement, which was measured by 6 items (Cronbach's alpha =.901). An example question was "Leveling up your character as fast as possible". The second factor, escapism, was measured by three items (Cronbach's alpha = .793). An example question was "Games I play help me escape from reality".

The socializing motive scale was adopted from the subscale of Sense of Belonging, which is a part of the scale of Social Interaction in Online Game Team (SIOGT) (Lin, Chang, & Lin, 2014). The socializing score reveals that a deep level of an individual's relatedness to game peers and a sense of belonging to a team possibly occur in the online gaming process. The socializing motive scale includes 5 items (Cronbach's alpha = .924). An Example question was "I am a part of this team (guild/clan)".

3.2.2. Problematic internet use

We developed the PIU scale for college students that included fourteen self-reported items (Liao, Chen, & Lin, 2018). The scale was to measure five core behavioral symptoms (i.e., tolerance, withdrawal, impulsivity, preoccupation and craving). For example, preoccupation measures PIU. For example, "I rush to the Internet whenever I have a chance." Responses to each question were measured on a 5-point Likert scale. The score of each item is summed and yielded a total score that ranged from 0 to 56.

3.2.3. Beck Depression Inventory (BDI)

In this study, depression was measured by the Beck Depression Inventory (BDI-II; Beck, Steer, & Brown, 1996, pp. 978–0158018386), which consisted of 21 items. BDI-II is a way to measure depression severity by self-report. Each item was rated on a 4-point scale. The scores were summed and yielded a total score that ranged from 0 to 63. The Cronbach's alpha coefficients of BDI-II at time 1 to time 5 were 0.900, 0.918, 0.927, 0.933, and 0.941, respectively.

3.2.4. Academic performance

For academic performance data, participants were asked to evaluate their grades using five different levels: Poor (below 60 points), Mid-low (60–69 points), Medium (70–79 points), Med-high (80–89 points), and Top (above 90 points).

3.2.5. Stress

Self-reported academic stress and peer-relation stress. The points range from 0 to 10 and 10-point represents extremely stressful. An example item is "Currently the academic stress for me is___ point".

3.2.6. Gaming time

We collected information on online gaming frequency per week and average duration per gaming time on both weekday and weekend (i.e., Approximately how many hours do you spend online per game in a typical week, from Monday to Friday?).

3.3. Statistical analysis

For this study, latent profile analysis (LPA) was conducted using Mplus 7.0 (Muthe´n & Muthe´n, 2012), and a two-way mixed design analysis of variance (ANOVA) was conducted using IBM SPSS 20. LPA (Lanza, Flaherty, & Collins, 2003) was used to identify latent categorical variables that represented clusters of individuals who share similar profiles based on their self-reported gaming motives (advancement, escapism, and socializing) in time period one (T1). The suggested number of latent clusters was determined by information criteria indices: Akaike Information Criterion (AIC) (Akaike, 1987), Bayesian Information Criterion (BIC) (Schwarz, 1978, pp. 461–464), adjusted BIC (aBIC) (Sclove, 1987), and Vuong-Lo-Mendell-Rubin likelihood ratio test (VLMR) (Lo, Mendell, & Rubin, 2001), which examined whether a k-1 cluster solution fit better than a k cluster solution.

Table 1
Online gaming usage in weekdays and weekend for all participants for five time points.

	Time 1	Time 2	Time 3	Time 4	Time 5
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Weekday frequency per-week on online games	3.62 (1.96)	4.11 (1.36)	4.06 (1.30)	4.03 (1.25)	4.17 (1.27)
Weekday average **duration** per gaming time	2.66 (1.69)	2.60 (1.17)	2.60 (1.15)	2.73 (1.34)	2.54 (1.10)
Weekend frequency per-week on online games	1.89 (1.17)	1.98 (1.28)	1.84 (.89)	1.82 (.74)	1.97 (1.03)
Weekend average **duration** per gaming time	4.09 (2.99)	3.25 (2.13)	3.33 (2.17)	3.51 (2.09)	3.15 (1.92)

Furthermore, upon settling on a cluster solution, we compared the latent clusters based on PIU, depression, academic performance, and stress using two-way mixed design ANOVAs. With cluster as the between-subject factor, while the time points were the within-subject factor. A full factorial design was implemented while evaluating interactions among factors. Given that missing data were one common characteristic for this longitudinal analysis, the response propensity method (Li, Liau, & Khoo, 2011) was used to address data with missing at random (MAR).

4. Results

Before presenting the results regarding subpopulations of college online gamers, their weekly Internet usage is reported first as the basic information for all participants (see Table 1). On weekdays, participants spent between 3.62 and 4.17 times (for 5 days) playing online games ($1.25 < SD < 1.96$) across the five time points. The weekday average duration per gaming time was between 2.54 h and 2.73 h across the five time points. On weekends, participants spent between 1.82 and 1.98 times (2 days) in online gaming ($0.74 < SD < 1.28$) for the five time points. The weekly average duration per gaming time ranged from 3.15 to 4.09 h for the five time points. The data show that the participants spent substantial time each week in online gaming and could be viewed as evidence of their gaming involvement.

4.1. The number of clusters

To identify the optimal number of latent clusters that would classify the participants in terms of their advancement, socializing, and escapism gaming motives, we increased the number of latent clusters one at a time and recorded the information criteria indices (AIC, BIC, aBIC), *p*-VLMR, and entropy. The values of information criteria for different cluster solutions are presented in Table 1. The results indicated that the latent profile model containing 4 clusters fits the data best.

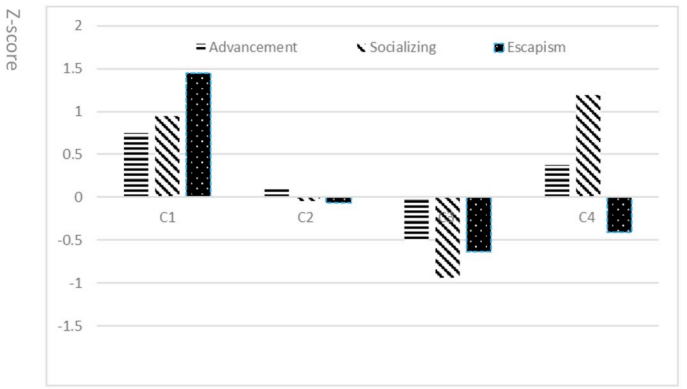
The 3-cluster solution was superior to the 2-cluster solution due to a significant *p*-VLMR value ($p < .001$) and lower AIC, BIC and aBIC values. Likewise, the 4-cluster solution was superior to the 3-cluster solution. In general, the 4-cluster solution was better than the 3-, 2- and 1-cluster solutions based on small BIC and aBIC values and a significant *p*-VLMR test ($p = .007$). Although the 5-cluster solution showed slightly lower AIC, BIC and aBIC values than the 4-cluster solution, *p*-VLMR was not significant ($p = .245$). Therefore, the 4-cluster solution was suggested as the best fit to the data.

4.2. The latent cluster characteristics

Latent cluster sizes and mean Z scores are shown in Table 2 and Fig. 2. Latent cluster 1 was named "high-engagement" (C1; advancement-high, socializing-mid-high, and escapism-high) and represented individuals with high levels of all three gaming motives compared with other clusters. high-engagement comprised 22% of the entire sample (n = 85; male: 74.12%). Latent cluster 2, named "medium-engagement" (C2; advancement-mid-low, socializing-mid-low, and escapism-mid-high) is the largest cluster, comprising 50% of the entire sample (n = 194; male: 72.16%), with scores in the medium-level for the three gaming motives. Latent cluster 3, "low-engagement" (C3; advancement-low, socializing-low, and escapism-low), characterized 12% of the sample (n = 48; male: 54.17%) with low gaming motives. Latent cluster 4, named "healthy-engagement" (C4; advancement-mid-high, socializing-high, and escapism-mid-low), involved 16% of the sample (n = 60; male: 81.67%). The healthy-engagement individuals hold the highest socializing motives compared with the other three clusters. However, their escapism motives are low to medium (lower than high-engagement and medium-engagement gamers), and advancement motives are at a medium level (lower than high-engagement

Table 2
Information criteria values for different cluster solutions.

No. of profiles	AIC	BIC	ABIC	*p*-VLMR	entropy
1	3289.582	3313.333	3294.296	–	–
2	3133.868	3173.452	3141.723	< .001	.648
3	3077.544	3132.962	3088.542	< .001	.750
4	3052.333	3123.584	3066.472	.007	.714
5	3041.420	3128.505	3058.701	.245	.751



	C1 high-engagement n = 85, male = 63	C2 medium-engagement n = 194, male = 140	C3 low-engagement n = 48, male = 26	C4 healthy-engagement N = 60, male = 49	F (3,383)	Eta^2
Clustering Variables	**(**Mean/SD)	(Mean/SD)	(Mean/SD)	(Mean/SD)		
T1_advancement	H (.74/.86)	ML (-.04/.74)	L (-1.51/.48)	M (.31/.87)	92.52***	.422
T1_socializing	MH (.88/.66)	M (-.40/.57)	L (-1.37/.32)	H (1.14/.52)	280.27***	.687
T1_escapism	H (1.43/.65)	M (-.22/.60)	L (-1.14/.44)	ML (-.44/.52)	249.65***	.663

Fig. 2. Time 1 (T1) LPA result and variables ANOVA summary: standardized mean scores and standard deviations of the four clustering variables. Note. Clustering variables: Means significantly differ from others across groups: H (high) > MH (Medium high) > M (medium) > Medium Low (ML) > L (low). Games-Howell test was applied for post hoc comparisons due to unequal variances in each cell. ***$p < .001$ four clustering variables.

gamers) (see Fig. 2).

4.3. Cross-time validation analysis: testing for the main effects and interactions among five periods and four latent clusters on PIU, depression, stress, and other backgrounds

Two-way mixed-design ANOVAs were used to examine differences among four latent clusters across 5 periods. Table 3 presents the summarized results.

4.3.1. Problematic Internet Use (PIU)

Based on the results of Mauchly's test, the assumption of sphericity was violated, $\chi^2 = 73.51$, $p < .001$ (Huynh-Feldt adjusted). The result showed a significant two-factor interaction (Time × Cluster), $F_{(11.001,\ 1404.505)} = 2.93$, $p < .01$, $\eta^2 = 0.022$. Therefore, a simple main effect for the clusters across different time periods was tested. The PIU of C1 was significantly higher than those of C2, C3, and C4 across the five time points (T1: $F_{(3,\ 383)} = 28.42$, $p < .001$, $\eta^2 = 0.18$; T2: $F_{(3,\ 383)} = 19.32$, $p < .001$, $\eta^2 = 0.131$; T3: $F_{(3,\ 383)} = 19.19$, $p < .001$, $\eta^2 = 0.131$; T4: $F_{(3,\ 383)} = 12.43$, $p < .001$, $\eta^2 = 0.089$; T5: $F_{(3,\ 383)} = 11.40$, $p < .001$, $\eta^2 = 0.082$). In addition, the cluster 1 (C1) PIU score at time 1 was significantly higher than those of time 2, time 3, time 4, and time 5 ($F_{(3.36,\ 282.54)} = 7.87$, $p < .001$, $\eta^2 = 0.086$); the C2 PIU score of time 2 was significantly higher than time 5. In summary, the PIU of the high-engagement cluster (C1) had significantly higher scores than other clusters across the five time points (see Table 3, Fig. 3). The PIU score of the high-engagement cluster at time 1 was significantly higher than other time points.

4.3.2. Depression (DEP)

Based on the results of Mauchly's test, the assumption of sphericity was violated, $\chi^2 = 49.08$, $p < .001$ (Huynh-Feldt adjusted). The result showed a nonsignificant two-factor interaction (Time × Cluster), $F_{(11.495,\ 1467.541)} = 1.711$, $p = .062$. The main effect for the time was not significant, $F_{(3.832,\ 1467.541)} = 1.502$, $p = .201$. There was a significant main effect for the cluster, $F_{(3,\ 383)} = 12.10$, $p < .001$, $\eta^2 = 0.087$, demonstrating that the C1 depression was significantly higher than C2, C3, and C4 ($p < .001$). In summary, the High-engagement cluster (C1) had significantly higher scores than other clusters in depression scores across the five time points (see Fig 3).

4.3.3. Academic performance

Academic performance: Based on the results of Mauchly's test, the assumption of sphericity was violated, $\chi^2 = 101.44$, $p < .001$ (Huynh-Feldt adjusted). The result showed a nonsignificant two-factor interaction (Time × Cluster), $F_{(10.644,\ 1358.92)} = 1.334$, $p = .202$. There was a significant main effect for time, $F_{(3.548,\ 1358.92)} = 15.36$, $p < .001$, $\eta^2 = 0.039$, showing that the T4 academic performance was significantly higher than T1, T2, and T3 ($p < .001$); T5 academic performance was significantly higher than T1, T2, T3 ($p < .001$). In summary, in time 4 and time 5, gamers had significantly higher academic performance than in time 1, time 2, and time 3 (see Table 3, Fig 3).

Table 3
Two-way mixed-design ANOVA for problematic Internet use (PIU), depression (DEP), academic performance, academic stress, and peer relationship stress.

		MSE	df1	df2	F	Eta^2	Post-hoc comparison
PIU	Time*Cluster	114.8	11.00	1404.51	2.93**	.022	
	Time (5)	206.9	3.67	1404.51	5.28**	.014	C1: T1 > T2, T3, T4, T5 C2: T2 > T5
	Cluster (4)	7659.00	3	383	26.2***	.17	T1: C1 > C2, C3, C4 T2: C1 > C2, C3, C4 T3: C1 > C2, C3, C4 T4: C1 > C2, C3, C4 T5: C1 > C2, C3, C4
BDI	Time*Cluster	39.41	11.50	1467.54	1.71	.013	
	Time (5)	34.60	3.83	1467.54	1.50	.004	
	Cluster (4)	2431.41	3	383	12.01***	.087	C1 > C2, C3, C4
Academic performance	Time*Cluster	.41	10.64	1358.92	1.33	.010	
	Time (5)	4.68	3.55	1358.92	15.36***	.039	T4 > T1, T2, T3 T5 > T1, T2, T3
	Cluster (4)	3.87	3	383	1.52	.012	
Stress academic	Time*Cluster	3.64	11.91	1520.08	1.35	.187	
	Time (5)	6.99	3.97	1520.08	2.59*	.007	T1 > T5 T2 > T5 T3 > T5
	Cluster (4)	147.23	3	383	9.74***	.071	C1 > C2, C4 C4 < C1, C2, C3
Stress peer relationship	Time*Cluster	5.28	11.66	1487.95	1.71	.013	
	Time (5)	16.92	3.89	1487.95	5.47***	.014	T3 > T2, T4, T5 T1 > T5
	Cluster (4)	201.12	3	383	10.89***	.079	C1 > C2, C3, C4 C2 > C3, C4

*$p < .05$, **$p < .01$, ***$p < .001$; C = cluster; T = time.

4.3.4. Stress

Academic stress: The results of Mauchly's test show that the assumption of sphericity was violated, $\chi^2 = 19.96$, $p < .05$ (adjusted using Huynh-Feldt correction). The two-factor interaction (Time × Cluster) was not significant, $F_{(11.907,\ 1520.08)} = 1.35$, $p = .187$. However, a significant main effect of time was found, $F_{(3.97,\ 1520.08)} = 2.59$, $p < .05$, $\eta^2 = 0.007$, showing that the time 1 academic stress was significantly higher than time 5 ($p < .05$), and the academic stress for time 2 was significantly higher than time 5 ($p < .05$); time 3 was significantly higher than time 5 ($p < .05$). A significant main effect for clusters was revealed, $F_{(3,\ 383)} = 9.74$, $p < .001$, $\eta^2 = 0.071$. The academic stress post hoc analysis of the cluster suggested that C1 academic stress was significantly higher than C2 and C4 ($p < .05$); the C4 academic stress was significantly lower than C1, C2, and C3 ($p < .05$). In summary, for academic stress, the High-engagement cluster (C1) had significantly higher scores than other clusters, and the Healthy-engagement cluster (C4) had significantly lower scores than other clusters (see Table 3, Fig. 3).

Peer-related stress: Based on the results of Mauchly's test, the assumption of sphericity was violated, $\chi^2 = 38.14$, $p < .001$ (Huynh-Feldt adjusted). The result (see Table 4) showed a nonsignificant two-way interaction (Time × Cluster), $F_{(11.65,\ 1487.95)} = 1.71$, $p = .062$. The main effect for the time was significant, $F_{(3.89,\ 1487.95)} = 5.47$, $p < .001$, $\eta^2 = 0.014$, showing that the T3 peer-related stress was significantly higher than T2, T4, T5 ($p < .01$), and the peer-related stress for T1 was significantly higher than T5 ($p < .01$).

There was a significant main effect of the cluster, $F_{(3,\ 383)} = 10.89$, $p < .001$, $\eta^2 = 0.079$, demonstrating that the C1 peer-related stress was significantly higher than C2, C3, C4 ($p < .001$), and C2 peer-related stress was significantly higher than C3 and C4 ($p < .05$).

In summary, for peer-related stress, the High-engagement cluster (C1) had significantly higher scores than the other clusters, and the Medium-engagement cluster (C2) had significantly higher scores than the Low-engagement cluster (C3) and Healthy-engagement cluster (C4).

5. Discussion

5.1. The latent cluster characteristics

A total of 387 online gamers who were mainly males (71.8%) participated in this study for a period of two years (2012–2014), which accounted for five time points. The average age of the participants was 19.43 years old at time 1. LPA was used to identify four

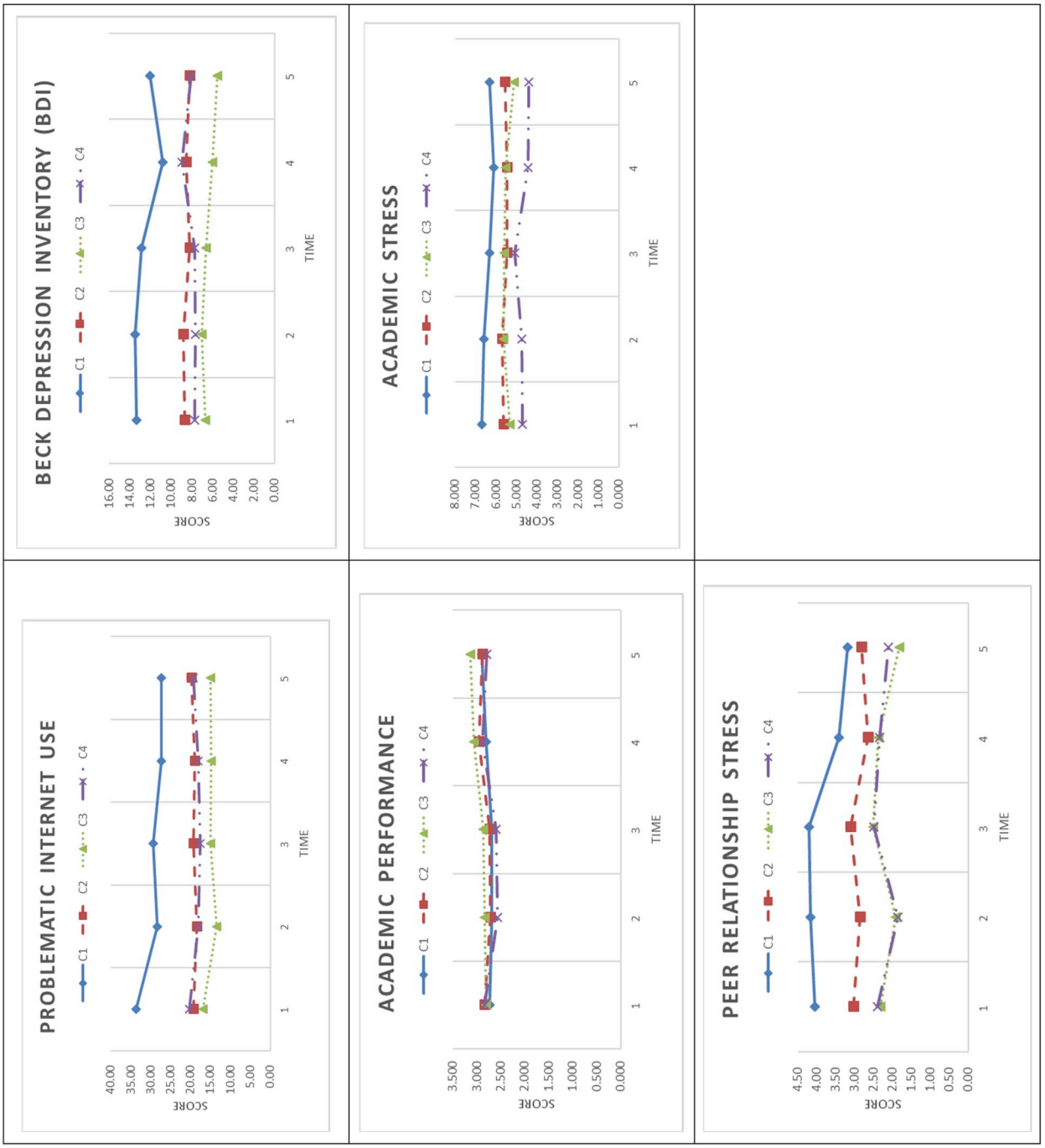


Fig. 3. Comparison of 4 clusters on five time-points psychological outcomes. Note. C1 (solid line) high-engagement cluster; C2 (short dashed line) medium-engagement cluster; C3 (dotted line) low-engagement cluster; C4 (long dashed line) healthy-engagement cluster.

clusters of gamers based on different levels of gaming motives. Regarding the gaming motives of the four subtypes, the first cluster (C1) was coined as "high-engagement" gamers (n = 85, male = 63) who had the highest advancement and escapism motives compared with other clusters, while the C1 cluster reported med-high socializing scores (second to health-engagement gamers). The second cluster (C2) "medium-engagement" gamers (n = 194, male = 140) contained a major proportion of all participants. Compared to other clusters, the C2 cluster advancement scores and socializing motives were med-low, while escapism was mid-high. The third cluster (C3), low-engagement gamers (n = 48; male = 26), had the lowest advancement, socializing, and escapism motives. In the C3 cluster, the male to female ratio was close to 1:1, while in other clusters, males outnumbered females. The above three clusters were named simply according to their motive profile. However, the fourth cluster (C4), "healthy-engagement" gamers (n = 60, male = 49), were named not only according to their motive profile but also quality well-being levels. For the motive profile, they had the highest socializing motives among the four clusters; their advancement scores were medium-high (second only to the High-engagement gamers), and the escapism motives were medium-low. For well-being levels, further explanation is provided below.

5.2. Depression, PIU, stress, and academic performance

The profiles were examined to show differences (from time 1 to time 5) between the four clusters on maladaptive indictors, such as depression (BDI), problematic Internet use (PIU), academic stress, and peer-related stress, as well as other facts, such as academic performance. The most important result of this examination was the comparison between high-engagement versus the other three clusters, especially the comparison between high-engagement versus healthy-engagement clusters. high-engagement gamers showed a high risk of depression and PIU compared with the other three clusters across time 1 to time 5, showing the development of maladjustment. Although academic performance mainly showed no difference across the 4 clusters across time points, high-engagement gamers had the highest academic stress among all clusters, while Healthy-engagement gamers had the lowest academic stress comparatively. Nevertheless, High-engagement gamers had high Peer-related stress compared with the other three clusters; Peer-related stress was low for Healthy-engagement gamers and low-engagement gamers.

This study confirmed the expectation that gamers endorsed multiple motives simultaneously. The strengths of this study were to demonstrate the "authentic" gamer clusters and the compositions of gaming motives in college gamers because we used a person-centered analysis (LPA in the current study or K-mean clustering analysis adopted by Billieux and colleagues in 2015). Billieux et al. (2015) used gaming motives, self-esteem and impulsivity to observe the clustering effect and negative outcomes of gamers of all possible ages in a cross-sectional online survey. Instead, our study adopted only three gaming motives to observe the clustering effect of college gamers and investigated negative outcomes in the later five time points.

Our results showed that some distinct participant profiles were not observed in the real world. For example, there was no cluster of "high escapism with low advancement/low socializing" (pure escapism cluster) or "high advancement with low escapism/low socializing" (pure advancement cluster). The examination between the differences between two "pseudo distinct clusters" may reveal very clean and clear evidence regarding the distinction of three gaming motives. However, there is no such chance in the real world to develop clean and clear patterns of gaming motives. We believe that the differences among these four authentic clusters displayed in the real world could help to discover the genuine inner and behavioral conditions of gamers.

5.3. Escapism as a risk factor

From the examination of gamer characteristics among the profiles, we found that high-engagement gamers had high risks of developing negative psychological symptoms; in contrast, healthy-engagement gamers showed quality well-being, regardless of PIU, depression, or stress. It was shown consistently at the five time points. Regarding the contrast of the motive profiles of these two clusters, the high-engagement cluster (C1) had high scores in both advancement and socializing motives, as did the healthy-engagement cluster (C4), while the high-engagement cluster had high scores in escapism, whereas the healthy-engagement cluster demonstrated low escapism motives. We suggest that high advancement and socializing motives in games provide a "sufficient condition" for maladaptive development for gamers. However, the escapism motive seems to be a "necessary condition" for the risk of maladjustment in a long period of college life.

Escapism has consistently been shown to predict gaming disorder or problematic gaming in previous studies (Billieux et al., 2015; Fuster, Carbonell, Chamarro, & Oberst, 2013; Király et al., 2015; Kircaburun, Jonason, & Griffiths, 2018; Kuss, Louws, & Wiers, 2012; Kwon, Chung, & Lee, 2011; Laconi, Pires, & Chabrol, 2017; Yee, 2006b). Based on Kim (2017) results, adults suffering from depression and Internet gaming addiction were more likely to play online games to avoid negative emotions. In previous studies (Young, 2009; Hussain & Griffiths, 2009a; Li, Liau, A., &; Khoo, 2011; Kaczmarek & Drążkowski, 2014), escapism includes forgetting real world troubles, hiding personal appearance and inner weaknesses, concealing personal low self-esteem and loneliness, or the lack of active power. In addition, escapism has been shown to be not only a gaming motive but also a coping strategy (Kaczmarek & Drążkowski, 2014; Kardefelt-Winther, 2014). Our results have shown that high stress (academic and social) and high depression were apparent for high-engagement gamers across a period of two college years. Playing online games may be repeatedly used as one of the coping strategies to escape from life stress and lingering depression. Based on past studies, playing games could help to improve mood or increase positive emotions (Aldao, Nolen-Hoeksema, & Schweizer, 2010; Gross & John, 2003; McGonigal, 2011; Ryan, Rigby, & Przybylski, 2006).

5.4. Advancement and socializing motives might not as risky

The healthy-engagement cluster (C4) had high scores in both advancement and socializing motives; in contrast, the low-engagement cluster (C3) had low scores in both advancement and socializing motives. These clusters had similar low scores in escapism motives. We found that both clusters had nonsignificant low levels of well-being indicators, such as depression, problematic Internet use, academic stress, and peer relationship stress. In other words, gamers with high or low advancement and socializing motives could have similar levels of well-being. In previous studies, gaming behaviors related to advancement and socializing motives had been suggested to provide positive effects. For example, Chang and Lin (2014) interviewed core gamers to describe their team process and found gamers actively seek difficult challenges in games and collaborated with their partners (showing a need to socialize) to achieve difficult goals would feel a sense of accomplishment (showing a need for advancement). In addition, core gamers would develop profound trust and camaraderie among team members. Sourmelis, Ioannou, and Zaphiris (2017) reviewed empirical studies on MMORPGs gamers from 2010 to 2016, suggesting that social interaction and team collaboration were important skills in the 21st century. Social skills trained in games could be used in the real world.

Ryan, Rigby, and Przybylski's (2006) study showed that gamers' sense of competence and autonomy in game help them to experience the joy and happiness of gaming. A gamer's sense of intuitive controls, presence, or immersion in game causes a psychological “pull” of games, resulting in satisfaction and happiness. In our study, the advancement motives reflected the needs to level up avatars, seek rewards, or gain fame in the gaming community that seemed to produce the pull effect to keep gamers in the virtual worlds.

Furthermore, Chang et al. (2018) propose that escapism could be a “push” power because frustration or other negative experiences of real world might push gamers into virtual worlds. high-engagement gamers represented approximately 22% of our sample happened to show the conjunction of pull and push effects in their profile. They had high escapism motives and the outcome effect showed that they had higher academic stress and peer-related pressure compared with other clusters. We suggest that stress may push gamers into playing games. When gamers develop competency in the game, obtain advancements and friendship, it may compensate the difficulties faced in real-life. Gamers who faced frustration or stress in real life may get involved in gaming as a quick and easy way to get relaxed.

5.5. Limitations and future research

This study had two limitations. First, there is a potential response bias, with a relatively low estimated response rate from time 2 to time 5. Second, the participants were college students with gaming experiences, and most of them reported playing multiple games simultaneously. This study grouped them into various clusters with their gaming motives at time one to keep the result analysis comprehensible.

For future studies, a person-centered analysis is recommended to supplement the results of variable-centered research. In the early stage of gamer behavioral studies, researchers frequently use variable centers to explore the critical roles of concerned variables and their effects. The main task of the variable-centered study is to develop theories and models. However, the gap between theory/model and reality might need the use of person-centered analyses to explore intercorrelations among variables that variable-centered studies might not be able to clarify. In addition, future person-centered studies may provide further insights to help gamers with functional impairment. Based on our findings, future studies could design intervention programs based on the pull-push effect described above or to bring awareness to gamers’ own escapism motives.

6. Conclusion

We found 4 clusters from a sample of gamers based on their gaming motives. The most important finding of this study is regarding the “high-engagement” gamer cluster. They had the highest advancement and escapism motives compared to the other clusters, with med-high socializing scores (second to healthy-engagement gamers). Consequently, in five time points they showed a higher risk of depression and PIU compared to the other three clusters, displaying signs of maladjustment development. Their academic performance had no significant difference compared with the other clusters across different time points; nonetheless, they showed the highest academic stress among all clusters.

In contrast, we found a cluster, named as the “healthy-engagement” gamers. The main difference between the gaming motives of the high-engagement and the healthy-engagement gamers was that the high-engagement gamers had higher escapism scores, while the healthy-engagement gamers had the lowest escapism scores among the four groups. The healthy-engagement gamers demonstrated quality adjustment. Therefore, the escapism motives might be the key motive for the problematic gamers.

Acknowledgement

This research was funded by the ROC National Science Council through three projects: “The Net and Taiwan Adolescents’ Physical and Mental Development” (NSC 97-2631-S-009-001), “Internet Use and Well-being of Taiwan Students: Longitudinal Analysis and the Extension of Fact Bank” (NSC-100-2631-S-009-001), and “Internet Use and Its Socio-cultural Impacts on Taiwan Adolescent Students” (NSC 97-2631-S-415-003).

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